Assessing the Feasibility of Using Telemedicine to Identify Depressive Symptomatology within the Long-Term Home Parenteral Nutrition Population

By

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Abstract

Home Parenteral Nutrition (HPN), a common nutritional support therapy, corrects for nutrient imbalances caused by a malfunctioning gastrointestinal tract outside a medical in patient setting. Patients utilizing HPN face psychosocial challenges, particularly depression, that go undetected due to their confinement within a home environment and lack daily interactions with healthcare professionals. Telemedicine, as a mode of treatment, can assist healthcare professionals in the detection of depression. In the current study, raters coded 25 long-term HPN patients in facilitated group discussions with the modified Raskin scale (a 21-item observer rating scale) to assess the feasibility of utilizing a technology- supported platform to identify depressive symptomatology within a chronically ill population. Results showed the modified Raskin appears to have predictive but not concurrent validity. Thus, the modified Raskin scale showed promise as a tool for healthcare professionals, who wish to use telemedicine as a treatment avenue to detect and monitor depression amongst long-term HPN patients.

Table of Contents

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Nutrition support therapies are required for multiple underlying pathologies that cause malnutrition and nutrient imbalance (Kirby, 2012). Home Parenteral Nutrition (HPN), a nutrition support therapy, addresses the nutrient imbalance specifically caused by a malfunctioning gastrointestinal tract and increases life expectancy outside of a medical inpatient care setting and within a home environment (Baxter, Fayers, & McKinlay, 2006; Huisman-de Waal, Schoonhoven, Jansen, Wanten, & van Achterberg, 2007; Persoon et al., 2005). Limited epidemiological data exist regarding HPN use within the United States. However, previous data collected from 1989 to 1992 showed that 120 per 100,000 individuals utilized HPN (DiBaise & Scolapio, 2007). In a more recent survey in 2010, the National Center for Health Statistics approximated that 33,000 individuals, across the lifespan, received HPN (Winkler, et al., 2015). With the cost of HPN calculated to be around $652 million, HPN causes a financial burden on the health care system (Winkler, et al., 2015). The financial burden is compounded further when other complications associated with HPN arise. For instance, extant literature has shown that HPN patients' experience not only physical complaints (e.g., diarrhea) but also psychosocial concerns related to their treatment. While majority of the physical concerns can be resolved in the home environment, HPN patients' psychosocial concerns, specifically depression, are left unaddressed (Baxter et al., 2006; Huisman-de Waal et al., 2006; Persoon et al., 2005). These unaddressed psychosocial concerns accrue additional cost (around $80 billion), causing additional strain to the United States' healthcare system (Howard, 2006). Thus, to address depression within the HPN population, it is imperative that healthcare professionals are able to

detect depressive symptoms as they appear, so they may offset healthcare cost, reduce psychosocial concerns and improve quality of life among HPN users.

Detecting and addressing both physical and psychosocial concerns can be difficult with HPN users, particularly those receiving treatment outside of a hospital setting. The advent of telemedicine as a potential mode of treatment has allowed healthcare professionals to treat patients in the home environment. Telemedicine increases HPN users' access to healthcare professionals (e.g., mental health specialists) and vital health care resources. Thus, telemedicine reduces barriers to medical care. However, questions remain about whether the absence of face-to-face contact may limit the ability of healthcare professionals to detect psychological problems, like depression, particularly in chronically ill population. Therefore, in the current study, we investigate whether it is feasible to assess depressive symptomatology during a telemedicine encounter with patients in the long-term HPN population.

Background

Launched in the late 1960s, HPN, "a life-saving therapy," was a treatment protocol prescribed to correct for dysfunction in the gastrointestinal tract through a formula solution delivered intravenously to the individual in their home environment (Howard Lyn J, 2002; Winkler, Ross, Piamjariyakul, Gajewski, & Smith, 2006; Winkler & Smith, 2014; Winkler & Guenter, 2014). This treatment ensures the body gains the necessary vitamins and nourishment to counteract malnutrition caused by the malabsorption of the gastrointestinal tract (Huisman-de Waal, Schoonhoven, Jansen, Wanten, & van Achterberg, 2007; Zhao et al., 2013). HPN requires the surgical insertion of a port and a Hickman line, a central venous catheter tunneled under the chest wall, which allows a feeding tube to be connected to a bag that contains nutritious aqueous solution for feeding (Baxter et al., 2006; Howard, 2002; Metzger, 2010). Before being released

from the hospital setting, HPN patients and caregivers are educated about the administration of HPN (Baxter et al., 2006; Metzger, 2010). Healthcare professionals provide precise systematic instructions and training on the feeding process, which involves infusing an aqueous nutritional solution using an electronic pump. HPN patients also learn aseptic techniques to create and maintain a sterile environment to care for their equipment (e.g., catheters, port, and pumps) and to avoid infections and other complications. Overall, the process of administering HPN can cause undue burden upon patients as they are tasked to be hypervigilant and conscientious while performing their care in an effort to avoid dire consequences that can result in negative health outcomes, such as death.

HPN is used to treat a variety of diseases that can cause malnutrition and malabsorption (Howard, 2006; Huisman-de Waal et al., 2007). Duration of treatment with HPN varies by diagnosis (Howard, 2006). For instance, surgical complications and enterocutaneous fistulae would require patient to undergo short-term HPN (< 1 year) with the end goal of restoring gastrointestinal function (Howard, 2002; Kirby, 2012). However, HPN can be used "long-term" when gastrointestinal function cannot be restored. Examples of primary diagnoses commonly associated to long-term HPN are inflammatory bowel syndrome, short-term bowel syndrome, Crohn's Disease, and mesenteric ischemia (Howard, 2006; Persoon et al., 2005). Inflammatory bowel syndrome and short bowel syndrome account for the majority of cases that require long-term HPN (Baxter et al., 2006; Staun et al., 2009;Winkler et al., 2015;Winkler & Smith, 2014). Long-term HPN patients tend to be middle-aged patients who have a 90% survival rate on HPN (Howard, 2006; Winkler et al., 2015). Nevertheless, long-term HPN patients show a reduction of quality of life and increase in psychosocial concerns due to being on HPN (Chambers et al., 2006).

Healthcare professionals have considered the employment of HPN to be cost-effective and beneficial to patients (Howard, 2006; Kim et al., 2014; Winkler et al., 2006; Zhao et al., 2014). HPN permits an earlier discharge from the hospital setting and allows patients to receive treatment at home (Zhao et al., 2013). HPN, in turn, lowers healthcare costs because home care is typically less costly than hospital care. For instance, HPN therapy expenses include the various components (e.g., dressing kits, nutrient solution, and infusion pump) that support treatment (Howard, 2006). In a hospital setting, PN therapy includes not only direct costs (e.g., supplies, physician and laboratory services) but also indirect costs, including administration fees and floor space. Investigators estimate that HPN therapy reduces healthcare costs about "30% - 60%." With Medicare and Medicaid reimbursement for HPN therapy, expenses related to therapy have been estimated to "cut the total management cost by about half" and reduce cost to the individual. Furthermore, HPN allows patients to receive treatment in a familiar environment and satisfy the patient's nutritional needs while increasing survival rates about 15-25 years across the spectrum of diseases that result in its use (Persoon et al., 2005; Winkler et al., 2006).

Although HPN is a lifesaving procedure, the HPN can result in patients experiencing negative health outcomes with regard to not only their underlying condition but also the administration of HPN. Commonly, HPN patients engage in a process where they infuse overnight and repeat the process on a 10-hour to 14-hour cycle. This process often results in physical and psychosocial complaints—like fatigue, discomfort— as HPN patients must deal with interruptions to their sleep cycle because of the noise interference from their equipment and relevant fear of dislodging their catheters as they sleep (Chambers, Hennessy, & Powell-Tuck, 2006; Chambers & Powell-Tuck, 2007; Howard, 2006; Persoon et al., 2005; Winkler et al., 2006). HPN patients also experience distress as HPN therapy may restrict activity to the home environment if they are

unable to manage feeding and maintaining a sterile environment outside the confines of their home. Hence, HPN administration can cause drastic changes in daily routines in ways that can impair psychosocial functioning. For example, HPN patients confined to the home environment may experience a decrease in social interaction and not be able to participate in previous pleasurable activities outside the home. In turn, these complaints may result in a decrease in quality of life and increased occurrence of depression within this population (Howard, 2006; Winkler et al., 2006; Winkler, 2005).

As stated above, quality of life in the HPN population is considerably reduced compared to the disease- free population (Huisman-de Waal et al., 2007; Persoon et al., 2005). Patients receiving HPN frequently report exhaustion, "loss of energy and optimism, fear", apprehension due to the future, and concern about the underlying disease (Huisman-de Waal et al., 2007; Winkler & Smith, 2014). HPN patients also reported a loss of independence and loss of engagement in previous activities (Baxter et al., 2006; Huisman-de Waal et al., 2006, 2007; Persoon et al., 2005). Although seen infrequently, female HPN users have reported concerns of body image due to the ports and tunneled catheters implanted in the body (Baxter et al., 2006; Huisman-de Waal et al., 2007; Winkler & Smith, 2014). These concerns may reflect the presence of or contribute to the high prevalence of depression reported by patients with HPN (Baxter et al., 2006; Huisman-de Waal et al., 2006, 2007; Persoon et al., 2005; Winkler & Smith, 2014;. Winkler, 2005; Winkler & Guenter, 2014). Another study conducted by Howard (2006) discovered a reduction in quality of life in those who rapidly transition from good health to using HPN and in those who are just beginning HPN treatment. According to the author, factors that lowered quality of life were the following: "loss of employment, loss of income, and decreased social interaction (Howard, 2006)." These factors found in the study certainly contribute to

negative mood states leading to the increased diagnosis of depression disorder within the HPN population. Consequently, HPN users are at a higher risk to experience a reduced quality of life due to HPN therapy than their healthy counterparts.

Researchers also have documented the presence of depression. For instance, in a study conducted in the Netherlands, investigators assessed 48 HPN long-term users about issues that they faced while on HPN (Persoon et al., 2005). HPN users reported decreased sleep functioning and anxiety. Investigators also found that thirty-one individuals scored high enough on the Beck Depression Inventory checklist to classify as being at risk for a "depressive disorder." Thus, over half of the sample population endorsed depressive symptoms. Patient interviews revealed that depression seemed to be linked to patients' perceived inability to take care of themselves (Huisman-de Waal et al., 2007; Persoon et al., 2005). Contributing to their negative mood states, participants indicated concern about their inability to engage in activities that were available to them before using HPN. For instance, participants spoke about difficulties in enjoying social activities (e.g., a party) or traveling outside of the home due to their inability to eat. As such, it is not surprising that HPN patients are documented within the literature as having an increased risk of experiencing depressive symptoms or associated negative mood states (i.e., anxiety and anger).

Since long-term HPN patients face an increased risk of depression and reduction of quality of life, healthcare providers should aim to increase monitoring and identifying the presence of depressive symptomology within this population. Unfortunately, long-term HPN patients are commonly restricted to the home environment and experiences reduced access to mental healthcare providers. Alternative avenues outside of traditional modes of treatment need to be used to assess for depressive symptomatology. An available alternative avenue is telemedicine.

Telemedicine allows long-term HPN patients to have increased access to healthcare providers and the essential services they provide. Moreover, investigators have demonstrated that telemedicine is comparable in its effectiveness to treat depression to traditional mode of therapy (i.e., face-to-face therapy)(De Las Cuevas, Arredondo, Cabrera, Sulzenbacher, & Meise, 2006; Khatri, Marziali, Tchernikov, & Shepherd, 2014; O'Reilly et al., 2007). With long-term HPN patients designated by the federal government as being a technology dependent because of their reliance on technology (i.e., infusion pumps) for survival, this population has been primed to accept the introduction of telemedicine, which should provide treatment support. Indeed, researchers investigate the use of telemedicine within the HPN population have shown HPN patients to be amendable to utilizing videoconferencing as another avenue for treatment (Saqui et al., 2007; Smith et al., 2015). This finding is supported in a recent study (Smith et al., 2015), where researchers found HPN patients as well as healthcare professionals willing to communicate utilizing videoconferencing through the use of mobile health technology (Smith et al., 2015). Using telemedicine to identify and monitor depressive symptoms within this population is a feasible solution for both healthcare professionals and HPN users.

Theoretical Model

To accurately access the feasibility of utilizing telemedicine to identify depressive symptomatology compared to traditional modes (face- to- face), a framework that assesses the effectiveness of telemedicine interventions was used to guide the current study. The Model for Assessment of Telemedicine (MAST) is a popular framework used in Europe to evaluate the application of telemedicine interventions (Kidholm et al., 2012). The MAST framework has three major components: (1) preceding consideration, (2) multidisciplinary assessment, and (3) assessment of transferability. The preceding consideration component comprises of identifying

the purpose in which the technology shall be used and if the technology is sufficiently developed to support the intervention. The multidisciplinary component includes the following domains (1) health problem and characteristics of the application, (2) safety, (3) clinical effectiveness, (4) patient perspectives, (5) economic aspects, (6) organizational aspects, and (7) social-cultural, ethical, and legal aspects. The last component transferability refers to extrapolating the intervention to other settings and populations. The current study meets the preceding consideration criteria as we have demonstrated a clear purpose for utilizing developed technological resources on a national level. The focus of the current study explores in depth the multidisciplinary component, specifically the clinical effectiveness of utilizing of telemedicine to identify symptoms of depression.

Extant research has shown telemedicine being effective in treating depression in different medical populations (e.g., pain, diabetes, and disability); however, limited evidence exists in identifying depressive symptoms using telemedicine versus traditional diagnostic tools, such as structured interviews and self-report measures (Baron, Hirani & Newman, 2016; Chavooshi, Mohammadkhani, & Dolatshahee, 2016; Choi, et al., 2014; Mochari-Greenberger, 2016; Salisbury, et al., 2016). To assess whether telemedicine can identify depressive symptoms, the current study has modified an existing validated scale, the Raskin Three- Area Severity of Depression rating scale (see Appendix A). Currently, the modified scale is the best option to detect depressive symptoms through telemedicine since it allows for easier detection of depressive symptoms within an unstructured interview. Hence, using the modified scale allows the current study to explore not only whether depressive symptoms can be in identified through telemedicine but also add to the existing literature regarding the efficacy of telemedicine versus traditional diagnostic tools.

Purpose

Data for this study came from a larger clinical trial designed to demonstrate the receptiveness of HPN users to telemedicine as a mode of treatment (Smith, et al., 2015). The purpose of the current study was to extend Smith, et al.'s findings by assessing the feasibility of utilizing telemedicine- a technology- supported platform- to identify depressive symptomatology within long-term HPN population. As reported in the literature, long-term HPN patients experience an increased risk of depression and tend to be confined to the home environment. As such, long-term HPN patients would benefit from increased monitoring for the earlier identification of depressive symptoms to improve quality of life and HPN treatment. Building from the extant literature and theoretical framework, it was hypothesized that telemedicine would be a viable mechanism by which trained medical professionals could monitor and identify of depressive symptomatology within the long-term HPN population. Hence, we expected that healthcare professionals using telemedicine would be able to identify depressive symptoms effectively. Aims of this study are specified below.

Aims

Study Aim 1: To assess the interrater reliability of the modified Raskin in rating the presence of depressive symptoms amongst raters. Statistical Package for Social Sciences -22 (SPSS-22) software packages will be utilized to calculate the appropriate statistical test, kappa, and to confirm interrater reliability.

Study Aim 2: To establish the criterion validity of the Raskin scale. We hypothesized that raters would be able to identify depressive symptoms utilizing the modified Raskin scale. Raskin items were compared to self-report. Analysis included creating an overall sum for the Raskin

scale and utilized SPSS to conduct an Ordinary Least Squares (OLS) regression to examine whether the Raskin scale predicted the presence of depression as indicated by the patient reported PHQ-9.

Study Aim 3: To identify items on the modified Raskin scale that correlated strongly and poorly with the PHQ-9 scores. Content analysis was used to identify categories of symptoms as identified by the Raskin scale: behavioral symptoms (e.g., crying, poor eye contact, fidgeting), verbal report (e.g., limited speech production, complains of loss energy), and secondary symptoms (e.g., complaints of insomnia, change in appetite). We hypothesize that secondary symptoms from the modified Raskin scale would correlate poorly and behavior symptoms and verbal report from the modified Raskin scale would correlate strongly with the PHQ-9.

Methods

The dataset presented in the current study was procured from a clinical trial study proposed by Carol Smith, Ph.D. and funded by the National Institutes of Health (NIH) and registered on the USA Clinical Trials.gov as Registration # NCT0190028. The NIH clinical trial enrolled 126 participants to examine the feasibility of telemedicine (mobile technology) to provide health care services to long-term HPN users and caregivers as well as assist this population with self-care and coordinating that care with other healthcare professionals. The Institutional Review Board at the University of Kansas Medical Center approved the original study and confidentiality has been kept with all patient information (i.e., videos) kept on a secure drive.

Participants

Researchers recruited participants through the University of Kansas Medical Center, associated rural health centers, and the Oley Foundation. Participants were eligible to participate

if they were HPN user and had a caregiver (non HPN- user) who agreed participate in the study, fluent in English, and able to provide informed consent. Exclusion criteria included any participants that had a disability or disorder that prevented them from using a mobile tablet. In the current study, participants were excluded if they were below the age of 18 (n=2), did not participate in the facilitated group discussion (n=2), were not a HPN user (n=38) or in the control group (n=59).

Questionnaires

Demographic Questionnaire. Participants completed a demographic questionnaire that collected information about income, insurance, and participants' use of HPN (e.g., reasons for HPN and duration of HPN).

Patient Health Questionnaire-9 (PHQ-9). PHQ-9 (Kroenke, Spitzer, & Williams, 2001) is a nine- item questionnaire that asks respondents to respond to items such as I have "little interest or pleasure in doing things" on a four- point, Likert scale. The PHQ-9 was created to monitor and/ measure the severity of depressive symptomatology and has shown excellent internal reliability (alpha = 0.89) and test-retest reliability. The PHQ-9 has also shown excellent discrimination between individuals with depression and individuals without depression. Kroenke, et al. (2001) demonstrated that the PHQ-9 has good criterion validity with regard to its ability to identify and predict depressive symptoms. Kroenke, et al. also demonstrated good construct validity with the PHQ-9 strong relationship between "functional status, disability days, and symptom-related difficulty" (2001).

Raskin Three- Area Severity of Depression Rating Scale (Raskin scale). Before selecting the Raskin scale, the author reviewed the literature and consulted with depression experts on

depressive measures (e.g., Beck Depression Inventory-II, Montgomery-Asberg Depression Rating) that would allow for an observational assessment of depressive symptoms through an unstructured interview. The majority of the traditional depressive measures for adults relied on either self-report or a structured/ semi-structured interview conducted by the clinician to identify depressive symptomatology. However, the current study required a measure that could be used to rate symptoms of depression as they presented themselves in an unstructured group setting, rather than in a structured interview.

The Raskin scale (Raskin, Schulterbrandt, Reatig, & McKeon, 1970) was designed as an observer rater scale to measure changes in depressive symptoms of depressed individuals undergoing pharmacological treatment. The Raskin scale examines depression symptoms in three major areas— verbal report (e.g., feels blue, reports of crying spells), behavior (e.g., looks sad, lacking energy), and secondary symptoms (e.g., insomnia, change in appetite) with examples anchoring in each area. Raters rate the degree of severity from one (not at all) to five (very much), for each area. Thus, scores can range from three to 15 points to demonstrate the severity of the depression. Psychometric properties of the measure are limited; however, studies have shown the Raskin to have acceptable interrater reliability (.88 for the entire scale), good sensitivity but poor specificity (Fish, 2011; Nezu, et. al., 2000). The Raskin scale was selected because it differs from self-report and interview measures in that multiple sources of information (i.e., interview, patient self-report, or collateral information provided by others) are used to inform the assessment of depression symptom. This may make the Raskin the best option for an observer rating scale when interview data are not available.

The Raskin scale (see Appendix A) was modified to identify the presence of depression rather than the severity of a depressive mood. When modifying the Raskin scale, the author added

depressive symptoms specified by the Diagnostic Statistical Manual- 5 (DSM-5) and from the existing literature (Cummins, et al., 2015; Foley & Gentile, 2010). The author added the following symptoms in the Verbal Report domain: limited speech production and complaints of loss energy or fatigue; in the Behavioral Symptom domain: poor eye contact and flat facial expression; and Secondary Symptom domain: self-focus, previously reported depression and optional symptoms (i.e., sleep disturbances). An additional modification was made to the rating scale. Instead of rating each domain on a Likert scale, raters were asked to code the presence of the symptom under each domain by marking the presence of a symptom, a yes (1) or no (0), and tabulating the number of times the symptom occurred. Thus, the modified Raskin score could have ranged from 0-294. In practice, however, the items on the modified Raskin scale ranged from 0-4.

Procedure

As part of the original study, participants were sent a wireless touch-screen mobile Apple iPad Mini™ tablet (iPad). The iPad included a fourth generation (4G) unlimited data plan and a five mega-pixel camera that provided clear visual properties for participants. Polycom RealPresence encrypted software was installed onto the iPads to allow for secure videoconferencing between health professionals and participants. Participants completed a PHQ-9 questionnaire and engaged in a facilitated group discussion at baseline (T1). Participants then completed another PHQ-9 questionnaire a month after the facilitated group discussion (T2).

To assess whether depressive symptoms could be identified through videoconferencing, three raters reviewed 28 facilitated group discussions that were videotaped by an iPad. Raters were graduate students from the University of Kansas Clinical Psychology program with clinical experience in identifying depression. Raters underwent training in using the modified Raskin

Scale and were blinded to both PHQ-9 scores at T1 and T2. With the modified Raskin scale, raters recorded the presence of a specific symptom (e.g. poor eye contact) with a yes or no and tabulated the number the times that specific depressive symptom occurred. If raters reported difficulty with identifying or tabulating the presence of a depressive symptom, the other two raters were consulted. Videotapes were reviewed and discussed until all raters arrived at a consensus about the presence/absence of a depressive symptom.

Data Analysis

Statistical analyses were conducted using the Statistical Package for Social Sciences -22 (SPSS-22) software packages. To examine interrater reliability, interclass correlation coefficients (ICC) were calculated (Koo & Li, 2016; Shrout & Fleiss, 1979). Criterion validity was assessed by comparing the modified Raskin scale to the PHQ-9 at T1 and T2. An overall sum was created for the modified Raskin scale. An OLS was conducted to determine whether the modified Raskin scale correlated with patient reported depression symptoms on the PHQ-9 score at T1 and T2. Zero order correlations were examined to evaluate the relationship between subscales of the Raskin—Verbal Report, Behavioral Symptoms, and Secondary Symptoms and the total PHQ-9 score (T1 and T2).

Results

Characteristics of the sample

Twenty-five patients between the ages of 19-71 (M=41.76, SD= 14.36) were included in the analyses at T1. Participants were predominantly female (88%), Caucasian (96%), and were on HPN for at least two years (44%). See Table 1 for further description of the baseline demographics of the sample. Four patients out of the 25 patients from T1 were excluded from

analyses at T2 for the following reasons: three patients did not complete the PHQ-9 questionnaire at T2, and one participant died. We found no differences between those who completed the study and those who dropped out of the study.

Study Aim 1

To assess the interrater reliability of the modified Raskin scale, three clinical psychology graduate students rated three long-term HPN users on the modified Raskin scale after training. Interrater reliability was calculated using ICC. We used a two-way random effects model to examine the average measurement and absolute agreement between the raters (Koo & Li, 2016). The interrater reliability was found to be good to excellent amongst raters, ICC (2, 3) = 0.96 with a 95% confidence interval=0.83-0.999, F (2, 8) = 3.03, $p<.05$.

Study Aim 2

An OLS regression analysis was used to determine whether the total of the modified Raskin scale predicted self-reported depression symptoms as identified by the PHQ-9 at T1 (Table 2). The results indicated that the modified Raskin scale explained .8% of the variance [R^2=.008, F (1, 23) =1.88, p =.669] in the PHQ-9 at T1. In other words, there was no relationship between the modified Raskin scale and PHQ-9. Thus, the modified Raskin scale did not predict the presence of depression as measured by the PHQ-9. A second OLS analysis was performed to determine whether the modified Raskin scale predicted the presence of depression as identified by the PHQ-9 scores at T2. The results indicated that the modified Raskin scale explained 46.5% of the variance [R^2=.465, F (1, 19) = 16.486, $p< .01$]. It was found that the modified Raskin scale significantly predicted self-reported depression symptoms as identified by the PHQ-9 (β=.682, $p<.01$).

A follow-up analysis examined whether the difference between T1 and T2 was due to the loss of the four patients from T1. We removed the four patients lost at T2 and re-ran the OLS regression equation at T1 to determine whether that changed the relationship between the modified Raskin scale and PHQ-9 at T1. The results were essentially unchanged. The modified Raskin scale explained 3.5 % of the variance [R^2=.035, F (1, 19) =.681, p =.419] in the PHQ-9 at T1. Thus, the difference in the relationship between the Raskin scale and PHQ-9 at T1 and T2 was not an artifact of patient attrition.

Finally, in a second follow-up analysis we used an OLS regression analysis to determine whether the PHQ-9 at T1 or the modified Raskin scale at T1 predicted depressive symptoms at T2 after controlling for PHQ-9 at T1 (Table 3). The results indicated that PHQ-9 at T1 and the modified Raskin scale accounted for 67.9% of the variance [R^2=.679, F (2,18)= 18.997, p<.01)]. Both the PHQ-9 at T1 (β=.471, p<.01) and the modified Raskin scale (β=.594, p<.01) significantly predicted depressive symptoms as identified by the PHQ-9 at T2.

Study Aim 3

Pearson correlations were calculated between the domains—Verbal Report (VR), Behavioral Symptoms (BS), and Secondary Symptoms (SS)—of the modified Raskin scale and the PHQ-9 scores at T1 and T2 (Table 4). Nonsignificant Pearson correlations were found between all the domains of the Raskin and PHQ-9 at T1 (p=ns). However, significant Pearson correlations were found between the PHQ-9 at T2 and two of the Raskin subscales at T2 VR (r=.463) and SS (r=.659) and PHQ-9 at T2.

Follow-up analyses were conducted to identify specific Raskin items that correlated with the self-reported depression. Specifically, we examined zero-order correlations between the PHQ-9

at T1 and T2 and individual items from the modified Raskin scale (Table 5). Significant relationships exist between PHQ-9 at T1and "appears restless" (BS) (r=.405) and "previously reported depression" (SS) (r=-.509). Significant correlations exist between the PHQ-9 at T2 and "complains of loss energy or fatigue" (VR) (r=.474), the "complaints of insomnia" (SS) (r=.457), "self-focus" (SS) (r=.514), and optional symptoms (i.e., sleep disturbances) (SS) (r=.531).

Discussion

HPN is a common treatment that allows patients to receive competent care in the comfort of their own home, improving quality of life. However, patients on HPN lack the daily in person interaction with healthcare professionals, which may cause delay in identifying symptoms of depression by healthcare professionals. Thus, the purpose of the current study was to determine whether symptoms of depression could be identified over a video-supported platform utilizing an observer rating scale (i.e., the modified Raskin scale) as a way to avoid the delay caused by the lack of face-to-face interactions between patients and healthcare professionals. The results of this study suggest strong interrater reliability and mixed preliminary evidence regarding the criterion validity of the modified Raskin scale in identifying depressive symptoms over a video-supported platform compared to the PHQ-9.

The first AIM of this study was to assess the reliability of the Raskin scale. The interrater reliability as assessed by the ICC indicated that the raters were good to excellent in identifying depressive symptoms utilizing the modified Raskin scale, which supported our initial hypothesis. Documenting inter-rater reliability for an observer rating scale is of critical importance because the scale relies on the subjective interpretation and judgement of multiple raters. As such, multiple raters introduce measurement error, which negatively affects how well an observer

rating scale assesses the intended construct (e.g., depression) (Hallgren, 2012). We can reasonably assume that our use of multiple raters did not add excessively to the measurement error and compromise our ability to identify depressive symptoms using the modified Raskin scale.

The second and third AIMs of this study were to establish evidence of criterion validity by comparing the Raskin rating scale to an established self-report measure of depression symptoms. We predicted that the modified Raskin scale would be comparable to the self-report measure, PHQ-9, in detecting depressive symptoms. Unfortunately, there was little relationship between the total Raskin scale and the PHQ-9 at T1, indicating that these two measures of depression may not be measuring the same thing. Subdomain analysis proved similarly disappointing results. We had predicted that the two most objective domains of the Raskin that were based on observations of behaviors and verbal reports would have a stronger relationship to the PHQ-9 than the more subjective, secondary symptom domain. It is noteworthy, however, that although the relationship between behavioral symptoms and the PHQ-9 was not statistically significant, the effect size was much larger than the effect sizes of the relationship between the PHQ-9 and verbal reports or secondary symptoms (Refer to Table 4).

Interestingly, although there was no relationship between the Raskin subscales and the PHQ-9 at Time 1, we found that the modified Raskin scale was able to predict depressive symptoms when compared to the PHQ-9 at T2. Hence, our findings suggest that while raters demonstrated excellent interrater reliability the modified Raskin scale demonstrated evidence of poor concurrent validity and strong predictive validity. To ensure that this was not an artifact because of the loss of patients in T2, we re-analyzed the data at T1 excluding the four patients lost at T2. We found the same non-relationship between the modified Raskin and the PHQ-9 at T1 that was

seen in our earlier analysis, meaning that the loss of patients was not an artifact that caused our significant finding at T2.

There are several explanations for our mixed findings. One possible explanation is that the psychometric properties of the original Raskin scale are still evident in the modified Raskin scale. For instance, although the original Raskin scale had good sensitivity, the scale demonstrated poor specificity. Thus, our ability to differentiate depressive symptoms from symptoms of the illness may be compromised. Indeed, raters may mistakenly code illness behaviors as indicative of depression, which may be affecting the measure's concurrent validity.

An alternative explanation could be that the PHQ-9 overestimates the presence of depression symptoms. The current sample was comprised of patients with critical illnesses that necessitate the use of HPN. Long-term HPN users experience physical symptoms (e.g., fatigue and weight loss) as result of their treatment that are not due to psychological cause. For example, the PHQ-9 has three questions that ask specifically about fatigue, appetite, and sleep. However, long-term HPN users are unlikely to be able to distinguish the presence of a symptoms caused by HPN as opposed to a psychological origin. Because we did not have a gold-standard diagnostic interview, it is not possible to determine which measure over or underestimated the presence or severity of depression. Additionally, we must consider the impact of the group dynamics and its influence on rating the PHQ-9 at T1 and T2. HPN patients might have felt more comfortable in disclosing depressive symptoms on the PHQ-9 at T2 as they became comfortable with the study's team.

Consistent with AIM 3, we examined the correlation between the Raskin subscales and the PHQ-9 total score. Given that we were comparing observations to self-reports, we hypothesized

that the more objective Raskin scale domains, VR and BS, would have stronger correlations with the PHQ-9 than the more subjective secondary symptom subscale. Consistent with the overall score, we saw the same pattern at T1—weak non- significant concurrent relationships between the modified Raskin subscales and the PHQ-9. However, we saw significant correlations between the modified Raskin scale domains to the PHQ-9 at T2. Surprisingly, the pattern of relationships was not as expected. The strongest relationship was between SS and the PHQ-9 at T2. VR was also a significant predictor of the PHQ-9 at T2. However, the BS domain had a non-significant relationship with the PHQ-9 at T2. We expected the behavioral domain to be easier to rate than the other domains. However, raters reported difficulty in rating behavioral symptoms because of the nature of the video-supported platform. Meaning, raters noted technical difficulties (i.e., poor video quality, constant moving of mobile tablet) that hindered their ability to successfully rate behavioral symptoms. In contrast, VR and SS relied on participants reporting symptoms, which were not influenced by video quality. Participants mostly reported sleep disturbances, fatigue related to their use of HPN. They also discussed weight loss and gain in reference to their use of HPN. Participants did talk about depressive symptoms. However, they usually reported such symptoms that had occurred in the past. Thus, VR and SS were easier to rate than BS, which may explain why VR and SS had a positive, significant relationship, but BS was not related to PHQ-9 at T2.

Refining the Raskin Scale

Overall, the modified Raskin scale demonstrated a poor ability to identify depressive symptoms compared to the PHQ-9 when administered simultaneously at T1. Hence, the PHQ-9 an inexpensive self-report measure seems to be a more appropriate tool than an observer rating scale—a disappointing finding considering that self-report measure may not be feasible when

interactions occur over a video-supported platform. However, we found that the modified Raskin scale has utility in predicting depressive symptoms at T2, specifically, the VR and SS domains of the modified Raskin scale. Given these findings, it seems appropriate to explore whether the modified Raskin scale could be refined to increase its utility in identifying people at risk for increased symptoms of depression or onset of an episode of depression.

Subsequent analysis identified a few significant relationships between individual items on the modified Raskin scale and the PHQ-9 at T1 and T2 (Refer to Table 5). Although a weak relationship existed between the modified Raskin scale and the PHQ-9 at T1, it is interesting to note that, "appears restless" and "previously reported depressed," had a strong, positive relationship with the PHQ-9 at T1. T1 observations: "complains of loss energy or fatigue", "complaints of insomnia", and behavioral observations of "self-focus", and "optional symptoms"—demonstrated a strong relationship with the PHQ-9 at T2.

In examining individual items from the modified Raskin scale, we found it noteworthy that "self-focus" demonstrated a strong relationship with depressive symptoms as identified by the PHQ-9 at T2. Introduced by social psychologists in the seventies, self-focused attention has been documented in the literature to be closely related to depression (Ingram, 1990; Mor & Winquist, 2002; Pyszcynski, Hamilton, Herring, & Greenberg, 1989). Indeed, researchers have argued that depressed individuals engage in self-focused attention as a form of rumination, which is characteristic of depressed individuals. Self-focused attention as a form of rumination appeared to be supported by our current findings as self-focus predicted that HPN patients, who focused more on themselves at T1, would exhibit an increase in depressive symptomatology in T2.

Our results suggest that the modified Raskin scale was sensitive to self-reports of vegetative symptoms (e.g., insomnia) and behavioral-related depressive symptoms (e.g., talking only about themselves) reported by patients. The data also suggest that these items from the modified Raskin scale were strong predictors of depression at T2. As such, the modified Raksin scale could be reduced to these items to lessen the observation burden. Although it may be beneficial for patients to continue self-reports of depressive symptoms at baseline, using the modified Raskin scale may provide its greatest utility in predicting future depressive symptomology. Meaning, healthcare professionals may identify individual patients, who may not directly report these behaviors (e.g., vegetative, behavioral-depressive symptoms) at baseline, but would warrant further monitoring and support in treating depression symptoms in the future.

Surprisingly, the modified Raskin scale was not only a predictor of future depressive symptoms as indicated by the PHQ-9 score at T2 but a stronger predictor than the PHQ-9 score at T1 (Refer to Table 3). This is an interesting finding considering that the PHQ-9, an empirically validated measure of depression, was expected to be a stronger predictor of itself (PHQ-9 score at T2) than the modified Raskin scale. We posit that the modified Raskin scale as an observer rating scale allows professionals to identify vegetative, behavioral-depressive symptoms that are more indicative of a future experience of depression. Although PHQ-9 consists of questions regarding vegetative, behavioral depressive symptoms, it is dependent on patients' understanding as well as willingness to endorse these items. Alternatively, the modified Raskin scale allowed for a more refined assessment of these vegetative and behavioral symptoms as raters were not reliant on self-report but rather able to identify and objectively code for these behaviors.

The current study was the first to assess the ability to identify depressive symptoms over a video-supported platform with a screening tool that does not depend upon self-report or a structured interview. Thus, the study adds to the existing literature by providing a behavioral-rated measure utilized by healthcare professionals to detect depressive symptoms. By accurately and quickly identifying depressive symptomatology through a video-supported platform, we would be able to offer better treatment of depressive symptoms and have positive long-term health outcomes for the chronically ill population. The results of this study show that the modified Raskin scale was a reliable assessment of symptoms that may have predictive but not concurrent validity. Further studies focusing at the item level may improve both the validity of the scale and reduce the rater burden. Additionally, when examining the scale validity, studies also should examine the scale's ability to identify depressive symptomatology in different populations (i.e., older adults and ethnic, racial minorities) for further utility.

Limitations

There were a number of limitations that limit conclusions that can be drawn from this study. First, sample size limited power to detect significant relationships. Only twenty-five individuals were included in the analysis. In addition, because we included only long-term HPN users and excluded caregivers, we potentially restricted the range of symptomatology. Another limitation was the psychometric properties of the modified Raskin scale. The modified Raskin appeared to have poor specificity, perhaps an artifact left over from the original scale that potentially influenced the results. Both the modified Raskin scale and PHQ-9 are limited in detecting and differentiating between grief and reactive depression, which are common within the HPN population. Thus, this inability to differentiate between reactive depression, grief, and "true" depression could influence and limit how the PHQ-9 and modified Raskin scale's ability

to provide an accurate presentation of depressive symptomatology within this population. Finally, rating was compromised by the poor video quality, a limitation that made rating symptoms to be difficult. Since telemedicine relies partly on the use of a video-supported platform, the need for a clear, steady picture and audio is essential. Healthcare professionals interested in using a video-supported platform will continuously face various technical complications (e.g., poor video quality) that can cause difficulties in diagnosis and treatment of their patients. The PHQ-9 and the modified Raskin scale both dispA critical and final limitation of this study was the use of the PHQ- 9 as the criterion measure. The PHQ- 9 is a measure of depressive symptomatology and cannot be used to replace a clinical interview. Thus, the results reported here are ambiguous. Without a true criterion measure, it is impossible to know whether the PHQ-9 or the modified Raskin is a more accurate assessment of depressive symptomatology.

Conclusion

Our ability to identify depressive symptoms over a video-supported platform requires ongoing investigation, particularly in examining the psychometric properties of the modified Raskin scale. Investigators should examine the modified scale to improve and increase internal consistency and criterion-related validity. With a measure that could aid in early identification and monitoring of depressive symptoms, clinicians along with untrained healthcare professionals may make better use of technology as a mode of treatment and increase the positive long-term health outcomes for the chronically ill population, who may depend upon the use of telemedicine.

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Tables

Table 1

Characteristics of Long-Term HPN Users

Characteristics	n(%)	M (SD)
Sex		
Males	3 (12%)	
Females	22 (88%)	
Ethnicity		
Hispanic	2 (8%)	
Non-Hispanic	23 (92%)	
Race		
White	24 (96%)	
Black	1 (4%)	
Age		41.76 (14.36)
HPN Years		2.76 (.926)
1	1 (4%)	
2	11 (44%)	
3	6 (24%)	
4	7 (28%)	
Education		
Some high school/Currently in high school	1 (4%)	
Some college/Currently in college	6 (24%)	
Completed college or more	18 (72%)	
Marital Status		
Married	9 (36%)	
Divorced	5 (20%)	
Separated	1 (4%)	
Never Married	10 (40%)	
Household (#of people in home including yourself)		3.56 (2.256)
1 person	3 (12%)	
2 people	8 (32%)	
3 people	8 (32%)	
4 people	4(16%)	
5 people	2 (8)	
Modified Raskin Scale		3.28(3.458)
PHQ-9 at T1	25	7.88 (5.464)
PHQ-9 at T2	21	7.76 (5.638)

Note. HPN Years= Home Parenteral Nutrition; PHQ-9= Patient Health Questionnaire -9

Table 2

Summary of Ordinary Least Square Regression Analyses for the Modified Raskin Scale Predicting PHQ-9 at T1 and T2

	PHQ-9							
	T1 (n=25)				T2 (n=21)			
Variable	β	t	P	95% CI	β	t	p	95% CI
Constant		4.791	.000	[4.21, 10.61]		3.336	.003	[1.58, 6.89]**
Modified Raskin Scale	.090	.434	.669	[-0.54, 0.82]	.682**	4.060	.001	[0.51, 0 .58]**

*p<.05, ** p<.01

Table 3

Summary of Ordinary Least Square Regression Analyses for the Modified Raskin Scale and PHQ-9 at T1 Predicting PHQ-9 at T2

	PHQ-9 at T2 (n=21)			
Variables	β	t	P	95% CI
Constant		.774	.449	[-1.810, 3.923]
PHQ-9 at T1	.471	3.46	.003	[0.193, 0.790]**
Modified Raskin Scale	.594	4.37	.000	[0.472, 1.348]**

Note. PHQ-9 at T1: $R^2\Delta$= .338; Modified Raskin Scale: $R^2\Delta$=3.41; *p<.05, ** p<.01

Table 4

Correlation of Domains of the Modified Raskin Scale, Modified Raskin Scale Total, and PHQ-9 at T1 and T2

Variables	*M(SD)*	1	2	3	4	5	6
1. PHQ-9 at T1	7.88(5.46)	–					
2. PHQ-9 at T2	7.76(5.64)	.58**	–				
3. Verbal Report	.84(1.60)	.01	.46*	–			
4. Behavioral Symptoms	.56(1.12)	.33	.38	-.09	–		
5. Secondary Symptoms	1.88(1.90)	-.04	.66**	.71**	.13	–	
6. Modified Raskin Scale	3.28(3.46)	.09	.68**	.82*	.36	.92**	–

*p<.05, ** p<.01

Table 5

Correlation of Individual Items on the Modified Raskin Scale with the PHQ-9 at T1 and T2

Variables	*M (SD)*	1	2	3	4	5	6	7	8	9	10	11	12
1.Limited speech production	0(0)	.	.	.	.	.	.	.	.	.	.	.	.
2. Participant reports feelings of Hopelessness/ Worthlessness/Guilt	.12 (.33)	.	1	.	.67**	.	.	.70**	-.08	.	-.13	.	.
3. Participant complains of losing interest or pleasure in activities	0(0)	.	.	.	.	.	.	.	.	.	.	.	.
4. Reports Depressed Mood	.16(.47)	.	.67**	.	.	.	.	.	.	.	.	.	.
5. Wishes to be Dead	0(0)	.	.	.	.	.	.	.	.	.	.	.	.
6. Reports Crying Spells		.	.	.	.	.	.	.	.	.	.	.	.
7. Complains of loss energy or fatigue	.56(.96)	.	.70**	.	.71**	.	.	1	-.12	.	-.20	.	.
8. Looks Sad	.08(.40)	.	-.08	.	-.07	.	.	-.12	1	.	-.07	.	.
9. Crying	0(0)	.	.	.	.	.	.	.	.	.	.	.	.
10.Poor Eye Contact	.24(.72)	.	-.13	.	-.12	.	.	-.20	-.07	.	1	.	.
11.Speaks in low voice (Depressed Mood)	0(0)	.	.	.	.	.	.	.	.	.	.	.	.
12.Movements are slow	0(0)	.	.	.	.	.	.	.	.	.	.	.	.
13.Flat Facial Expression	0(0)	.	.	.	.	.	.	.	.	.	.	.	.
14.Appears Restless	.24(.88)	.	-.10	.	-.10	.	.	.23	-.06	.	-.09	.	.
15.Complaints of Insomnia	.16(.62)	.	-.10	.	-.09	.	.	-.16	-.05	.	.10	.	.
16.Complaints of Hypersomnia	.08(.40)	.	-.08	.	-.07	.	.	.312	-.04	.	-.07	.	.
17.Reports recent change in appetite	0(0)	.	.	.	.	.	.	.	.	.	.	.	.
18. Participant reports diminished ability to think or indecisiveness	.04(.20)	.	.55**	.	.81**	.	.	.75**	-.04	.	-.07	.	.
19.Self-Focus	.20(.58)	.	.52**	.	.64**	.	.	.84**	-.07	.	-.12	.	.
20. Previously reported depression	.60(.71)	.	.39	.	.57**	.	.	.28	-.18	.	-.13	.	.
21.Optional symptoms (e.g., sleep disturbance)	.80(.91)	.	.36	.	.46*	.	.	.47*	-.18	.	-.11	.	.
22. PHQ-9 at T1	7.89(5.46)	.	-.02	.	-.22	.	.	.12	.04	.	-.003	.	.
23. PHQ-9 at T2	7.76(5.64)	.	.31	.	.38	.	.	.47*	.	.	.129	.	.

Notes. N was 25 for every variable except for PHQ-9 at T2, which N was 21 due to missing data. . =no value. *p<.05, ** p<.01

Table 5

Continued

Variables	*M SD*)	13	14	15	16	17	18	19	20	21	22	23
1. Limited speech production	0(0)	.	.	.	.	.	.	.	.	.	.	.
2. Participant reports feelings of Hopelessness/ Worthlessness/Guilt	.12 (.33)	.	-.10	-.01	-.08	.	.56**	.52**	.39	.36	-.02	.31
3. Participant complains of losing interest or pleasure in activities	0(0)	.	.	.	.	.	.	.	.	.	.	.
4. Reports Depressed Mood	.16(.47)	.	-.01	-.09	-.07	.	.81**	.64**	.57**	.46*	-.22	.38
5. Wishes to be Dead	0(0)	.	.	.	.	.	.	.	.	.	.	.
6. Reports Crying Spells		.	.	.	.	.	.	.	.	.	.	.
7. Complains of loss energy or fatigue	.56(.96)	.	.23	-.16	.31	.	.75**	.84**	.28	.47*	.12	.47*
8. Looks Sad	.08(.40)	.	-.06	-.05	-.04	.	-.04	-.07	-.18	-.18	.04	0
9. Crying	0(0)	.	.	.	.	.	.	.	.	.	.	.
10. Poor Eye Contact	.24(.72)	.	-.09	.01	-.07	.	-.07	-.12	-.13	-.11	-.00	.13
11. Speaks in low voice (Depressed Mood)	0(0)	.	.	.	.	.	.	.	.	.	.	.
12. Movements are slow	0(0)	.	.	.	.	.	.	.	.	.	.	.
13. Flat Facial Expression	0(0)	.	.	.	.	.	.	.	.	.	.	.
14. Appears Restless	.24(.88)	.	1	.38	.89**	.	-.06	.56**	-.24	-.04	.41*	.38
15. Complaints of Insomnia	.16(.62)	.	.38	1	-.05	.	-.05	-.09	-.23	-.16	.19	.46*
16. Complaints of Hypersomnia	.08(.40)	.	.89**	-.05	1	.	-.04	.65**	-.18	.05	.39	.38
17. Reports recent change in appetite	0(0)	.	.	.	.	.	.	.	.	.	.	.
18. Participant reports diminished ability to think or indecisiveness	.04(.20)	.	-.06	-.05	-.04	.	1	.65**	.41*	.27	-.15	.34
19. Self-Focus	.20(.58)	.	.56**	-.09	.65**	.	.65**	1	.20	.32	.14	.51*
20. Previously reported depression	.60(.71)	.	-.24	-.23	-.18	.	.41*	.20	1	.58**	.51**	.20
21. Optional symptom (e.g., sleep disturbance	.80(.91)	.	-.04	-.16	.05	.	.27	.32	.581**	1	-.04	.53*
22. PHQ-9 at T1	7.89(5.46)	.	.41*	.19	.39	.	-.15	.14	-.51**	-.04	1	.58**
23. PHQ-9 at T2	7.76(5.64)	.	.38	.46*	.38	.	.34	.51*	.20	.53*	.58**	1

Notes. N was 25 for every variable except for PHQ-9 at T2, which N was 21 due to missing data. . =no value. *p<.05, ** p<.01

Appendix A

The Modified Raskin Scale

Domains	Sub-Domains	Present (Yes/No)	Tabulation (#)
Verbal Report	Limited speech production -Participant rarely spoke to others. If person spoke, it was short brief sentences.		
	Participant reports feelings of Hopelessness/Worthlessness/Guilt		
	Participant complains of losing interest or pleasure in activities		
	Reports Depressed Mood -Participant makes comments about feeling sad or feeling blue.		
	Wishes to be Dead -Participant reports suicidal thoughts/ or makes mentions of being better off dead/ or shows preoccupation with death.		
	Reports Crying Spells -Participant mentions crying because they are sad and upset.		
	Complains of loss energy or fatigue - Participant gives multiple reports of being tired and not able to do much (relevance to energy).		
Behavioral Symptoms	Looks Sad - Participant visibly frowns or looks upset.		
	Crying - Participant is visibly crying.		
	Poor Eye Contact - Participant does not make eye contact when being spoken too, nor does the person make eye contact when speaking.		

	Speaks in low voice (Depressed Mood) - Participant speaks in a low tone of voice (whisper and		
	Movements are slow - Participant tends to moves slow on camera or reports doing so.		
	Flat Facial Expression - Participant		
	Appears Restless - Participant appears to fidget within their seat and unable to stay still.		
Secondary Symptoms	Complaints of Insomnia - Participant reports unable to sleep.		
	Complaints of Hypersomnia - Participant reports sleeping all the time.		
	Reports recent change in appetite - Participant reports eating either a lot or not eating as much		
	Participant reports diminished ability to think or indecisiveness		
	Self-Focus - Participant does not offer advice or tend to be self-focused upon themselves.		
	Previously reported depression -Participant reported that they felt depressed before.		
	Optional Symptoms -Participant reports sleep disturbances.		